REMARKS

New claims 31 and 32 have been added. Thus, claims 1, 7, 9, 11-13, 16-18, 22, 24 and 27-32 are pending in the present application for further prosecution. Independent claims 1, 7 and 27 have been amended to distinguish over the prior art of record. No new matter was added. Accordingly, Applicants respectfully submit that claims 1, 7, 9, 11-13, 16-18, 22, 24 and 27-32 are in condition for allowance.

I. Claim Rejection - 35 USC §103(a)

A. In the FINAL Office Action dated September 29, 2009, claims 1, 9, 22 and 27-30 are rejected under 35 USC §103(a) as being obvious over U.S. Patent Application No. 2004/0222088 A1 of Subramani et al. in view of U.S. Patent No. 6,139,701 issued to Pavate et al.

Subramani et al. disclose an "electroplated" sputtering target. For example, see: the Title of the application publication; the Abstract ("a layer of sputtering material is electroplated ... to form the target"); Paragraph No. 0034 ("the subsequent layers 20a,b may be applied in an electroplating process"); and claim 1 ("A method of fabricating a sputtering target ... electroplating a layer of sputtering material ... thereby forming the sputtering target."). Accordingly, as best illustrated in FIGs. 2A-2D of Subramani et al., a sputtering target formed by electroplated layers is disclosed.

Thus, the sputtering target of Subramani et al. clearly has an electrodeposited metallic structure. Subramani et al. disclose that such a structure can be formed into a hollow body shape as shown in FIG. 2D of the Subramani et al. publication.

With respect to surface roughness (Ra), the FINAL Office Action cites Paragraph No. 0034 of Subramani et al. which specifically refers to the target (111) illustrated in FIG. 2D having a first electroplated layer (12) and subsequent electroplated layers (20a,b). This

paragraph merely states that the electroplated layers (12 and 20a,b) shown in FIG. 2D "may be further machined" for purposes of providing the "desired target dimensions" and a "smooth surface" (24). In FIG. 2D, the surface (24) is identified as the outer planar surface extending between two separate hollow bodies. Applicants respectfully submit that this vague suggestion of a "smooth surface" is non-enabling to one of ordinary skill in the art. "Smooth" is a relative term (see 35 USC §112, second paragraph) and is clearly undefined by the publication. Also, Subramani et al. are not clear with respect to what part of the target is provided with a "smooth" surface.

In the FINAL Office Action, a secondary reference, Pavate et al., is combined with Subramani et al. with respect to disclosing the surface roughness (Ra) required by claims 1, 9, 27 and 28 of the present application. However, as discussed in great detail in Applicant's previous response, Pavate et al. fail to disclose a hollow body, cup-shaped sputtering target. Rather, Pavate et al.'s disclosure is limited to a copper sputtering target having a tabular sputtering face (102a). For example, see FIG. 1 of the Pavate et al. patent in which the sputtering face (102a) of the sputtering target (102) is positioned within one end of a vacuum chamber (155) directly across from and parallel to substrates (140 and 150) onto which a thin film (152) is formed from atoms ejected from the sputtering face (102a) of the target. See column 3, line 10, to column 4, line 11, of the Pavate et al. patent for a discussion of the sputtering operation illustrated in FIG. 1.

Pavate et al. disclose a surface roughness of a planar sputtering face (102a) which is the erosion portion of the tabular target. Pavate et al. fail to disclose a "hollow cathode sputtering target" comprising an "inner bottom face" that forms a "non-erosion portion" of the hollow cathode sputtering target and a "cylindrical inner peripheral face" that forms an "erosion portion" of the hollow cathode sputtering target. Pavate et al. also fail to disclose that a surface roughness

(Ra) of the inner bottom face, which is a non-erosion portion of the hollow cathode sputtering target, is required to be Ra≤1.0μm or 0.5μm as well as being equal to or less than a surface roughness (Ra) of the cylindrical inner peripheral face which is an erosion portion of the hollow cathode sputtering target. In addition, Pavate et al. fail to disclose the problem created by the peeling of redeposited material on the inner bottom face of a hollow cathode sputtering target and certainly fails to provide a solution.

Applicant respectfully requests reconsideration and removal of the above referenced §103(a) rejection for the following reasons. As cited in the FINAL Office Action, the following first two inquiries are required to properly establish a rejection based on obviousness: (i) the scope and content of the prior art must be determined; and (ii) the differences between the prior art and the claims at issue must be ascertained.

As already stated above, the sputtering target of Subramani et al. differs from that required by claims 1 and 7 of the present application for at least two reasons.

First, Subramani et al. require a sputtering target having an electroplated metallic structure. In contrast, the claim 1, as amended, requires a "plastic worked" sputtering target which has a deformed metallic structure. No new matter was added; for example, see page 5, lines 15-17, of the present application, as filed. "Plastic working" of course refers to forging, rolling, deep molding, etc. disclosed on page 5, line 16, of the present application, as filed. Two figures are provided on the following page which illustrates, for purposes of comparison, a plastic formed (rolled) metallic structure versus an electrodeposited metallic structure. These structures are clearly different. Thus, the metallic structure disclosed by Subramani et al. is clearly different to that required by the "plastic-worked" target of the present application.

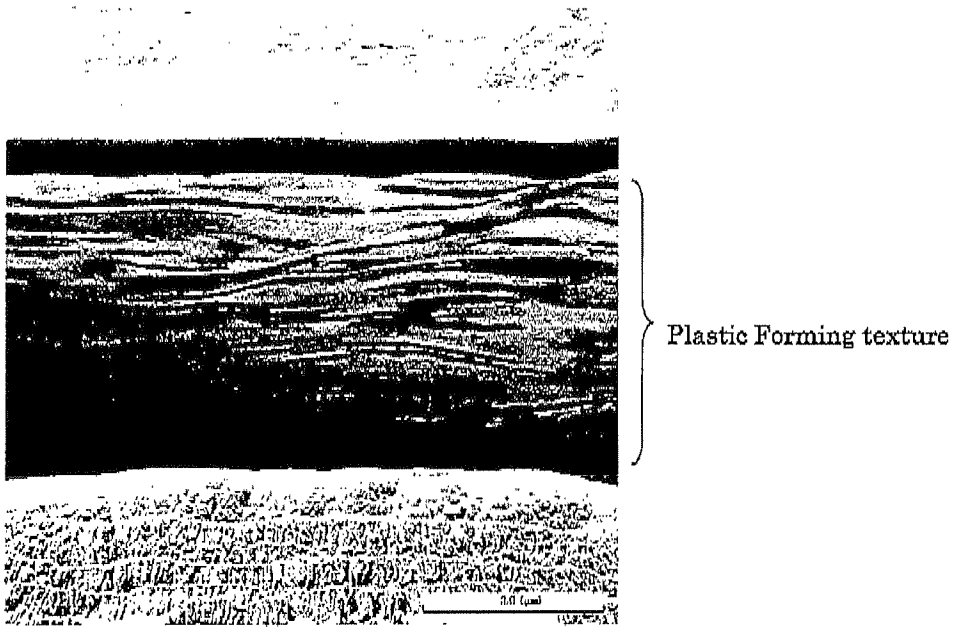


Fig. Plastic Forming texture (by rolling)

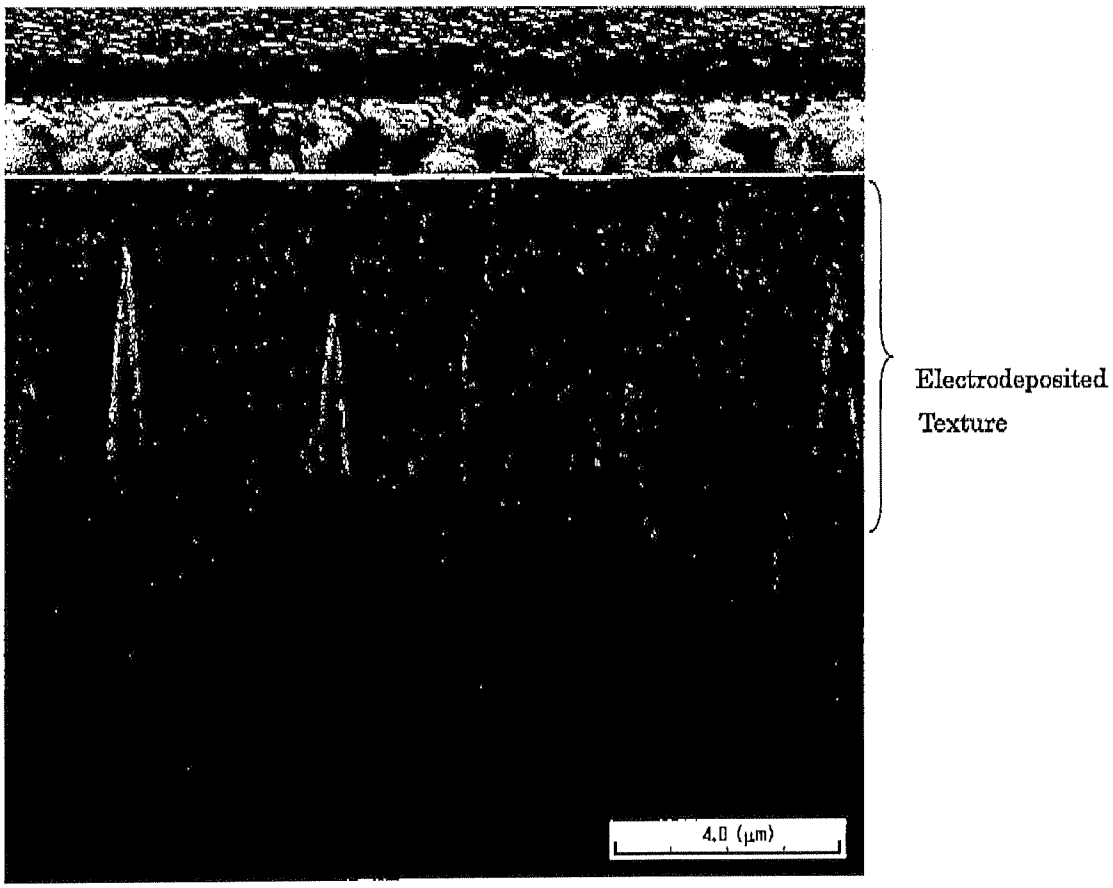


Fig. Electrodeposited texture

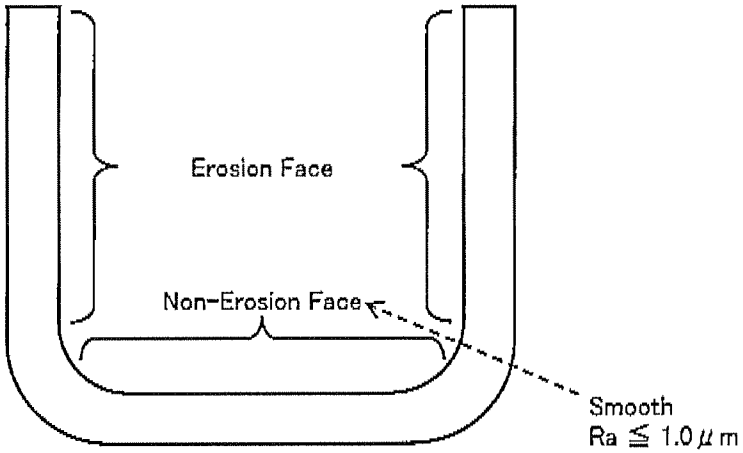
※ The both pictures size are fixed as the same scale.

A second difference is that Subramani et al. fails to disclose surface roughness. Paragraph No. 0034 of Subramani et al. specifically refers to the target (111) illustrated in FIG. 2D having a first electroplated layer (12) and subsequent electroplated layers (20a,b). This paragraph merely states that the electroplated layers (12 and 20a,b) shown in FIG. 2D "may be further machined" for purposes of providing the "desired target dimensions" and a "smooth surface" (24). In FIG. 2D, the surface (24) is identified as the outer planar surface extending between two separate hollow bodies. Applicants respectfully submit that this vague suggestion of a "smooth surface" is non-enabling to one of ordinary skill in the art. "Smooth" is a relative term and is undefined by the Subramani et al. publication. Also, it is not clear what part of the target is provided with a "smooth" surface.

With respect to the Pavate et al. patent, it clearly discloses only a tabular sputtering target and not a hollow body or cup shaped sputtering target. Drawings depicting the different shapes of such targets are provided on the following page.

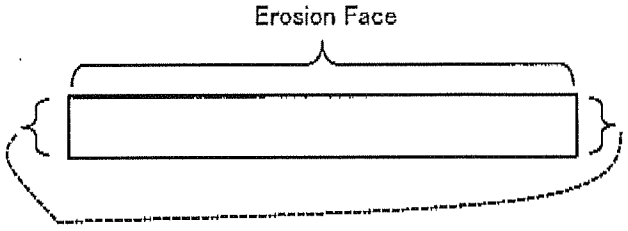
Also, Pavate et al. discloses that the sputtering face or erosion portion of the target be provided with a surface roughness of less than 5 micro inches. The prior art provides a clear and consistent teaching that the erosion portion of a sputtering target should have a low surface roughness whereas the non-erosion portions of a sputtering target should be roughened to function as a getter so that foreign particles become securely attached to such surfaces and are not permitted to easily peel away from such surfaces.

(Hollow Cathode Target according to the Present)



Formation of a Deposited Film

(Tabular Target)



Accordingly, Applicant respectfully submits that the cited prior art does not render claims 1, 9, 27 and 28 of the present application obvious. One of ordinary skill in the art following the cited combination of references would provide the erosion portion (inner cylindrical portion of a hollow body sputtering target) with a surface roughness of less than 5 micro inches and would roughen the non-erosion portions of the target (including the bottom inner face of a hollow body target). This is exactly opposite to that required by the claims of the present application.

A phenomenon unique to a hollow cathode sputtering target is that despite the fact that the inner bottom surface of the cup faces the space where plasma is generated, occupies a large portion of the opposing area, and is in close vicinity to the cylindrical erosion surface of the target, the inner bottom surface of the cup-shaped body is not eroded at all and thus forms a non-erosion surface of the target. A problem created by this is that sputtered substances can deposit on the bottom face and then ultimately peel away from the bottom face causing the generation of particles during sputtering creating defects on the sputtered thin film. This problem with respect to peeling of redeposited substances on the inner bottom face is **unique** to hollow cathode sputtering targets due to their non-planar cup-shape configuration. Tabular targets do not experience such a problem.

As discussed above, with respect to tabular sputtering targets, such as that disclosed by Pavate et al., one of ordinary skill in the art is taught to roughen non-erosion portions of targets to prevent peeling.

Nevertheless, Applicant has found that an "unexpected result" is provided by polishing the inner bottom face of a hollow body sputtering target to the extent required by the claims of the present application. The unexpected and non-obvious aspect of the present invention is that the non-roughened inner bottom face having a surface roughness equal to or less than 1.0μm or 0.5μm actually prevents peeling of re-deposited material. This is the exact opposite teaching

provided by the prior art and clearly provides a non-obvious unexpected result when applying the factual inquiries of Graham v. John Deere Co. as required for a rejection under §103.

Still further, Applicant respectfully submits that one of ordinary skill in the art would have no common sense reason for modifying the target of Subramani et al. according to the teachings of Pavate et al. concerning surface roughness. As stated above, the phenomenon of the inner bottom face of a hollow body sputtering target being a non-erosion portion of the target is unique to hollow body targets. Thus, Pavate et al. clearly fail to provide recognition of the problem addressed by the present inventor and certainly cannot be relied upon as providing an obvious solution. Still further, the surface roughness disclosure of Pavate et al. is limited to the erosion portion of the target, not non-erosion portions such as the inner bottom face of a hollow body target.

Accordingly, the claims of the present application require the surface roughness (Ra) of the inner bottom face of a hollow cathode-type sputtering target to be equal to or less than 1.0μm or 0.5μm and less than or equal to the surface roughness of the erosion portion of the sputtering target (i.e. inner cylindrical side wall of hollow target). An unexpected result is provide by this structure in that the inner bottom face (which has a deformed metallic structure and the above referenced surface roughness) actually prevents peeling of re-deposited material thereby reducing the generation of particles during a sputtering operation. This is clearly not taught nor rendered obvious by Subramani et al. or Pavate et al. and, in fact, is opposite to that taught by the prior art, namely, to roughen non-erosion portions of targets.

Accordingly, Applicant respectfully submits that claims 1, 9, 22 and 27-30 are patentable over Subramani et al. in view of the Pavate et al. reference.

Applicants also submit that claim 27 and new claims 31 and 32 are patentable for an additional reason. These claims require the surface roughness (Ra) of the inner bottom face to be

"less than" the surface roughness of the cylindrical inner peripheral erosion face of the target. This is clearly not disclosed, taught, or suggested by the prior art, and the prior art clearly teaches away from making the surface roughness of a non-erosion portion of a target less than that of an erosion portion.

Thus, Applicant respectfully requests reconsideration and removal of the obviousness rejection of claims 1, 9, 22 and 27-30.

B. In the FINAL Office Action dated September 29, 2009, claims 1, 7, 9, 22, 24 and 27-30 are rejected under 35 USC §103(a) as being obvious over U.S. Patent Application No. 2004/0222088 A1 of Subramani et al. in view of U.S. Patent No. 6,153,315 issued to Yamakoshi et al.

The Subramani et al. publication is discussed above in detail.

The secondary reference, Yamakoshi et al., discloses controlling the surface roughness of an erosion portion of a sputtering target. For example, column 2, lines 34-36, of Yamakoshi et al. discloses that "the number of produced nodules is reduced as the surface roughness of the sputtering target **surface to be eroded** was made smoother." Also see column 3, lines 10-25, of Yamakoshi et al. which teaches: "the surface roughness of **a surface to be eroded** is provided at 1.0μm or less" and then provides reasons for why this improves sputtering and reduces the number of particles generated. Thus, Yamakoshi et al. disclose a desired surface roughness for the erosion portion of the target, not the non-erosion portions of the target.

Accordingly, similar to Subramani et al., Yamakoshi et al. fail to provide any disclosure with respect to the surface roughness of a non-erosion portion of a target, and there is no common sense reason provided by Yamakoshi et al. for reducing surface roughness of a non-erosion inner bottom face of a hollow cathode sputtering target.

Applicant respectfully submits that Yamakoshi et al. merely teaches to one of ordinary skill in the art to limit the surface roughness of an erosion surface of a sputtering target. It fails to provide any teaching relevant to an inner bottom surface of a hollow cathode sputtering target or to a desired surface roughness of a non-erosion portion of the target.

Further, conventional practice is to roughen non-erosion surfaces of sputtering targets so that such surfaces function as a "getter" for capturing particles. For example, when an erosion portion is sputtered, particles that deviate from the subject become an unintended deposited material on non-erosion portions of the sputtering target. Ultimately, this deposited material will peel off during the sputtering operation and cause the generation of particles. As a known method for preventing this, the surfaces of non-erosion portions of sputtering targets are roughened to cause redeposited particles to firmly affix to the non-erosion portions whereby peeling is prevented. Thus, conventionally, measures are taken to roughen the surfaces of non-erosion portions of sputtering targets.

Further, Applicant respectfully submits that for the same reasons discussed above with respect to the rejection based on Subramani et al. in view of Pavate et al., claims 1, 7, 9, 22, 24 and 27-30 are patentable and non-obvious relative to Subramani et al. in view of the Yamakoshi et al. patent. Accordingly, Applicant respectfully requests reconsideration and removal of the rejection.

C. *In the FINAL Office Action dated September 29, 2009, claims 11-13 and 16-18 are rejected under 35 USC §103(a) as being obvious over U.S. Patent Application No. 2004/0222088 A1 of Subramani et al. in view of U.S. Patent No. 6,139,701 issued to Pavate et al. in further view of U.S. Patent Application No. 2002/0079217 A1 of Buehler.*

The deficiencies of Subramani et al. in view of Pavate et al. relative to the limitations of claim 1 of the present application are discussed above in detail.

The secondary reference, Buehler, discloses the use of imprints on non-erosion sidewall surfaces of a sputtering target to "retain redeposited material" to "prevent flakes of the redeposited material from falling off" the non-erosion surfaces during a sputtering operation. These imprints, of course, roughen the non-erosion portions and such surfaces would not have the surface roughness (Ra) required by the claims of the present application. Further, it is clear that one or ordinary skill in the art following the teachings of Buehler would roughen all non-erosion target surfaces, including the inner bottom face of a hollow body target. Thus, Buehler teaches away from the requirements in the claims of the present application.

Accordingly, Applicant respectfully submits that for the same reasons discussed above with respect to the rejection based on Subramani et al. in view of Pavate et al., claims 11-13 and 16-18 are patentable and non-obvious relative to Subramani et al. in view of Pavate et al. and further in view of Buehler. Accordingly, Applicant respectfully requests reconsideration and removal of the rejection.

D. In the FINAL Office Action dated September 29, 2009, claims 11-13 and 16-18 are rejected under 35 USC §103(a) as being obvious over U.S. Patent Application No. 2004/0222088 A1 of Subramani et al. in view of U.S. Patent No. 6,153,315 issued to Yamakoshi et al. in further view of U.S. Patent Application No. 2002/0079217 A1 of Buehler.

The deficiencies of Subramani et al. in view of Yamakoshi et al. relative to the limitations of claim 1 of the present application are discussed above in detail.

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that one or ordinary skill in the art following the teachings of Buehler would roughen all non-erosion target surfaces, including the inner bottom face of a hollow body target. Thus, Buehler teaches away from the requirements in the claims of the present application.

Accordingly, Applicant respectfully submits that for the same reasons discussed above with respect to the rejection based on Subramani et al. in view of Yamakoshi et al., claims 11-13 and 16-18 are patentable and non-obvious relative to Subramani et al. in view of Yamakoshi et al. and further in view of Buehler. Accordingly, Applicant respectfully requests reconsideration and removal of the rejection.

IV. Conclusion

In view of the above amendments and remarks, Applicant respectfully submits that the claim rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

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